EDDY CURRENT DEFECTOSCOPE FOR MONITORING THE DURALUMIN ALLOYS

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Eddy current testing, which forms part of the electromagnetic testing methods, is a non destructive testing (NDT) method that relies on electromagnetic induction to detect discontinuities in conductive material. Discontinuities such as geometrical changes, variations in material properties relating to conductivity and permeability and the presence of defects, both surface breaking and subsurface, can be detected [1].

The principle of operation of the ECT is based on the alternating magnetic field, localized in the controlled object with the help of the oxide pyramid shaped core. Exciting subminiature transmitter winding consists of 10 turns, and its diameter is 0.13-0.12 mm. Measuring winding consists of 130 turns and its diameter is 0.05-0.08 mm. Copper wire 5 μm thick is used to the wind the turns. The windings are wound on pyramidal shape core. To demonstrate the operational capability of the suggested method we used plate of the duralumin. Plate thickness was 5.3 mm. As a model defects used slits having a thickness of 0.25 mm. The defect was located at a distance of 1-5.3 mm from the probe in the plate.

Fig. 1 shows the picture observed when the probe moves above medium inside which a defect is located. The signal level from the measuring winding characterizes conductance values on the studied area.

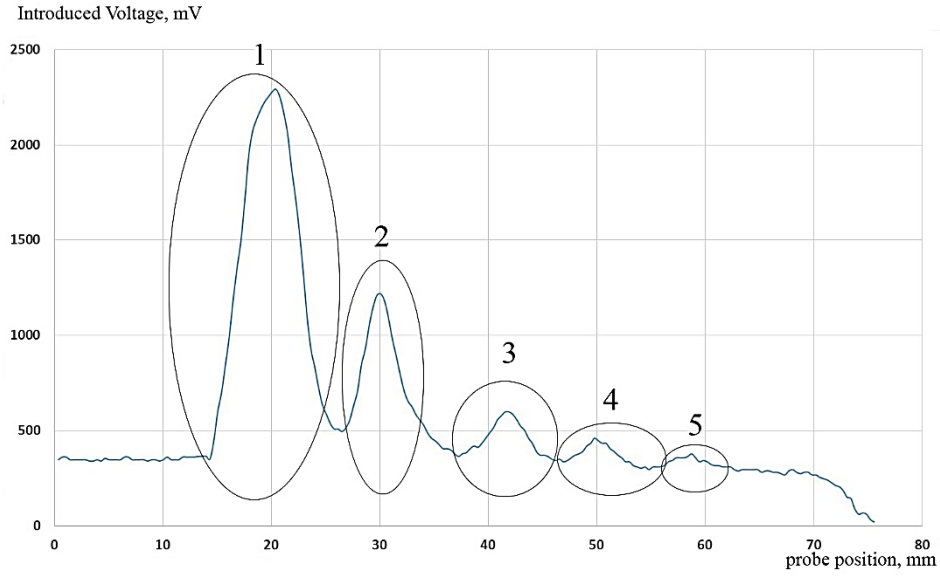

Fig. 1. Results of plate scanning. Differential inspection mode

The differential inspection mode utilise two probes in close proximity to one another and comparing one surface area with another. It is very sensitive for finding small indications and the effect of probe wobble and lift-off is also reduced since both coils are subjected to the same movement or distance influence.

Domain 1 and domain 2 in the graph, in which the voltage level drops to 3750-3250 mV, correspond to the defects 1, 2. Domain 3, 4 and 5 in the graph correspond to the deep-lying defects.

Summing it up, the experiment results demonstrate great capabilities of the eddy current method when the defects, hidden in the metal depth, need to be studied. Earlier the eddy current control method could be used to investigate only surface defects (such as cracks, cuts and other examples of metal surface discontinuity), now, due to using subminiature ECTs and special software, it is getting possible to localize the magnetic field in a small zone of the controlled object and to achieve a high degree of the (magnetic) field penetration depth into the investigated object.

1. Dmitriev S F, Ishkov A V, Malikov V N, Sagalakov A M and Katasonov A O. Non-destructive testing of the metal-insulator-metal using miniature eddy current transducers. IOP Conference Series: Materials Science and Engineering.71 (2014)

МОРФОЛОГИЧЕСКАЯ УСТОЙЧИВОСТЬ ДВИЖУЩЕЙСЯ ГАРМОНИЧЕСКИ ВОЗМУЩЕННОЙ ГРАНИЦЫ ДВУХ ЖИДКОСТЕЙ

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MORPHOLOGICAL STABILITY OF MOVING FLUID-FLUID INTERFACE UNDER HARMONIC PERTURBATIONS

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This work experimentally investigates morphological stability of round fluid-fluid interface under initial harmonic perturbations. Displacement of silicon oil by aqueous glycerol solution in a radial Hele-Shaw cell is studied.

В настоящей работе экспериментально исследуется морфологическая устойчивость границы при радиальном вытеснении в ячейке Хеле-Шоу [1] водным раствором глицерина силиконового масла (ПМС-5 [2]).

Ячейка Хеле-Шоу известной геометрии [1] в данном исследовании имела толщину b=0.6 мм. Дополнительно на нижнее стекло ячейки наклеивалась